

HIGH FREQUENCY INDUCTION HEATING

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About Us

FOUNDED IN 1975, SECOM IS A LEADING COMPANY FOR THE DISTRIBUTION AND PRODUCTION OF COMPONENTS AND DEVICES FOR POWER ELECTRONICS

SECOM continuously carries out new research and technical proposal in conjunction with important clients, providing technical support to meet their specific needs.

Production excellence and efficient organization allow SECOM to commit itself to providing to the market with timely and professional service in numerous sectors of static energy conversion. Flexibility and short delivery time have become pillars to SECOM's company policy.

WHO WE ARE



Over the years the company has become an important designer and manufacturer of power electronic devices for industrial automation manufacturing technologies

WHAT WE DO



SECOM studies and manufactures customized solutions on behalf of its customers.

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INDUCTION HEATING SYSTEM

Induction Heating is the process of heating an electrically conducting object by electromagnetic induction, where eddy currents are generated within the metal and its resistance leads to Joule heating. So it is possible to heat a metal without direct contact and without open flames or other heat sources (like IR).

An induction heater consists of an electromagnet (coil), through which a high-frequency alternating current (AC) is passed.

The frequency of AC used depends on the object size, material type, coupling (between the work coil and the object to be heated) and the penetration depth.

An induction heating system is composed by an inductor (to generate the magnetic field) and a converter (to supply the inductor with a time-varying electrical current).

Advantages of Induction Heating

- Improved final product quality since the parts to be heated have no contact with direct flames, eliminating any quality issue related to open flame treatment
- Very low scale formation due to shorter heating time than traditional gas furnace heat treatment
- High productivity because heat is developed instantly inside the workpiece
- Environmental friendly: induction heating does not burn traditional fossil fuels
- Safer process thanks to the elimination of smoke, waste heat, emissions and loud noise
- Reduced energy consumption due to a more efficient process with immediate heating availability



TYPICAL CABINET LAYOUT



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TYPICAL CABINET LAYOUT



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DEEP PURPLE

OVERVIEW

SECOM introduced in 2013 a new series of frequency converters designed to supply power to equipment that incorporates technology currently used in induction heating, hardening, smelting and/or other applications where a resonant circuit is required.

The “**Deep Purple**” is an IGBT power electronic inverter developed for a high-frequency induction heating application. The load current and the output frequency of the application define the rated power of the inverter. The power module is water-cooled.

Strength point of this solution are:

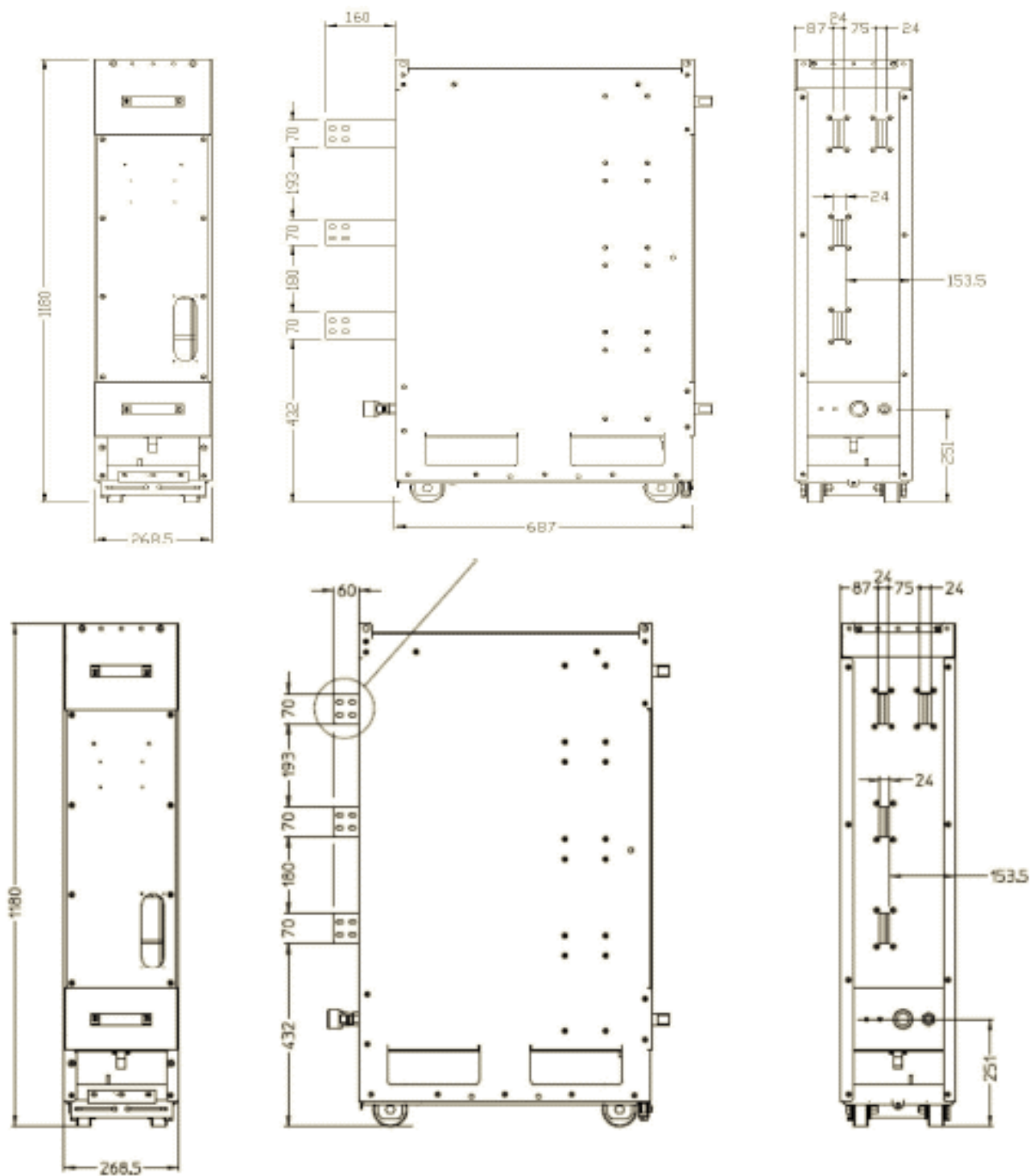
- IGBT High Frequency technology
- A drastically gas and smoke emission reduction typical of the old heating process
- A reduced energy consumption
- Immediate availability of the heating -> no need long start or stop sequences, as with traditional reheating furnaces.

H bridge configuration is used in SECOM induction heating converters.



DEEP PURPLE

DIMENSIONAL DRAWINGS



DEEP PURPLE

COOLING SYSTEM

The power modules are equipped with a cooling system circuit to refresh and cool down the main power devices such as IGBT and input thyristors.

The inlet and outlet of the cooling system are located on the bottom rear side of the module. A system of quick connect couplings guarantee a faster operation maintenance.

The main cooling data have described in tables below.

It is mandatory to respect the water flow value described.

Data	Value
Internal pipes water Volume (l)	4
Water Flow (l/min) min-max	35-40
Rated Pressure drop (bar)	3
Water Temperature (°C)	10-40*
Max Water Temperature (°C)	40*
Semiconductor losses (kW)	15
Busbar and internal losses (kW)	1,2

* For higher temperature is necessary to consider a derating of the power system

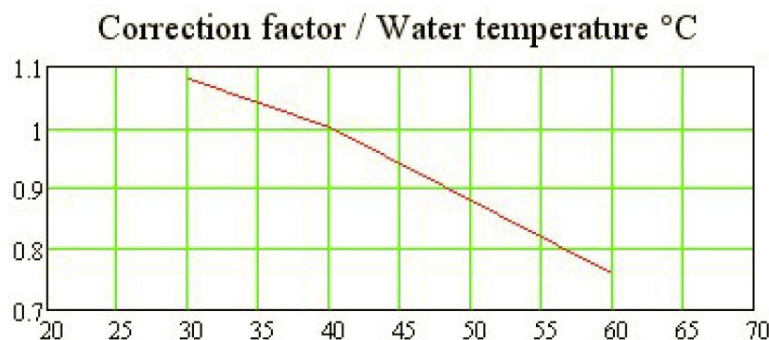


Fig. - Output current vs. water temperature

The power module is equipped with fans to ensure the cooling of the internal parts not watercooled. The cooling fans have to be supplied by an external power supply 230Vac 50Hz.

DEEP PURPLE

TECHNICAL DATA

Ambient conditions

Altitude	1000 m. a.s.l.
Air temperature	0 ÷ 40°C
Storage temperature	0 ÷ 50°C
Relative humidity	10 ÷ 90 %

Dimensions and weight

Height	1100 mm.
Width	270 mm.
Depth with short connection	798 mm.
Depth with long connection	898 mm
Weight	140 kg.

Electrical data

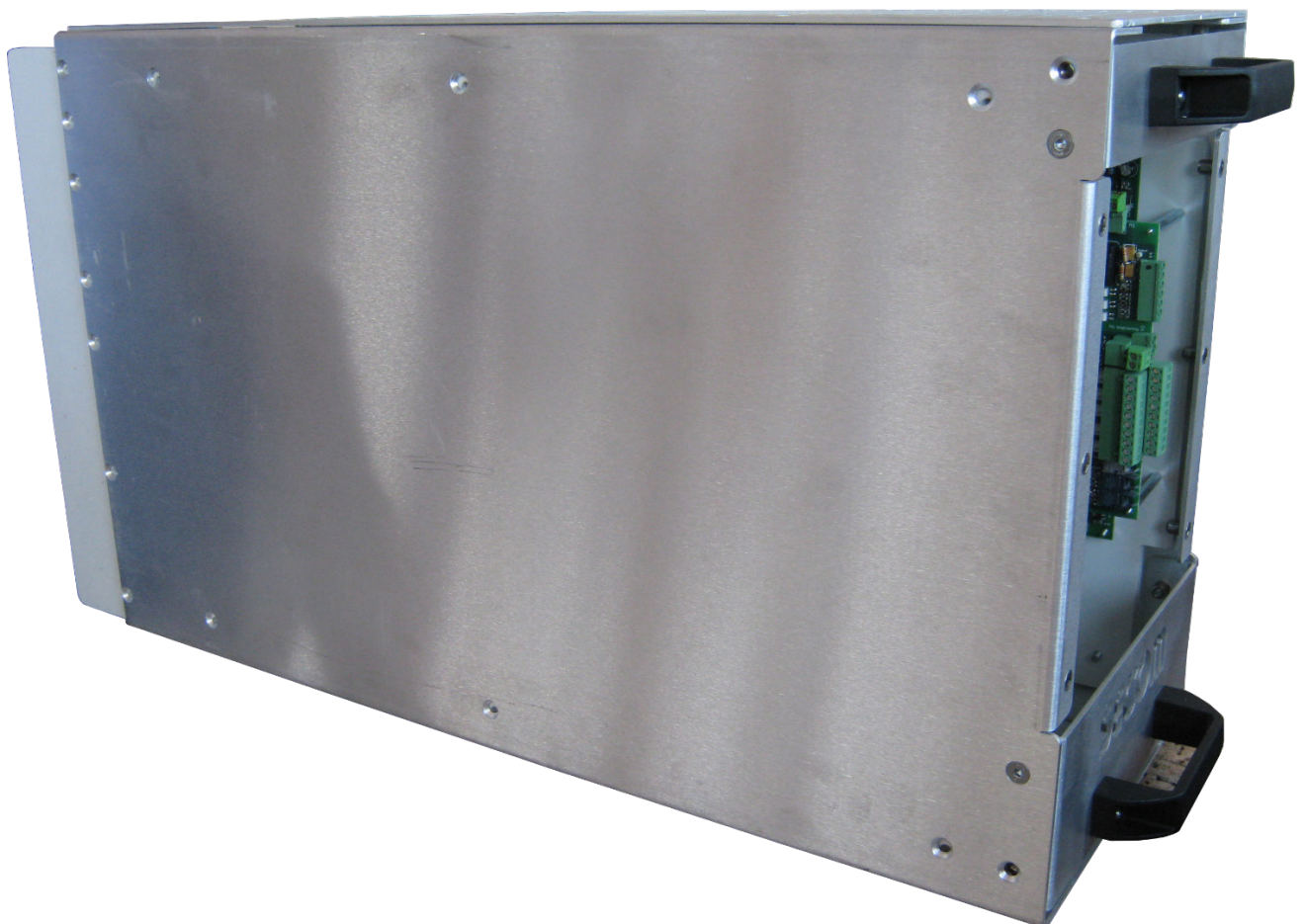
Inverter type	IGBT single phase inverter
Cooling system	Air / water
Rated current	1700 A
Supply voltage	600 ÷ 930Vdc
Output voltage (square waveform)	up to +VDCBUS
Output frequency	200 ÷ 1000 Hz

VIOLA

OVERVIEW

SECOM introduced in 2013 a new series of frequency converters designed to supply power to equipment that incorporates technology currently used in induction heating, hardening, smelting and/or other applications where a resonant circuit is required.

The “**Viola**” is a high-frequency converter that requires an Induction Heating. The output power is determined by the maximum output current and frequency required in the application itself.



The SD_HF is composed of a removable module as shown in the figure below.



VIOLA

COOLING SYSTEM

The modules are provided with water cooling circuits that guarantees the cooling of the main components (IGBTs and DC-link capacitors)

Water inlet and outlet valves are placed in the rear side of the module.

The cooling system characteristics are indicated in the table below.

Characteristic	Value
Volume (l)	3
Water Flow (l/min)	30
Pressure (bar)	1-3
Temperature range (°C)	10-43
Max Temperature (°C)	43

The module is provided by air intake on top and bottom side of the module to guarantee the appropriate ventilation of the internal parts not water cooled.

Warning! Keep clean the air intake, the grill obstructed could cause damage to the equipment. It is possible to use eventual cubicle ventilation to guarantee the correct air cooling of the module.

Inside the module two fans cool down the backup power supply that use the DC bus voltage to supply the electronic cards of the module in case of malfunctions of the main $24V_{DC}$ supply.

VIOLA

TECHNICAL DATA

Ambient conditions	
Altitude	1000 m. a.s.l.
Air temperature	0 ÷ 40°C
Storage temperature	0 ÷ 50°C
Relative humidity	10 ÷ 90 %

Dimensions and weight	
Height	442 mm.
Width	269 mm.
Depth (handle and bars)	798 mm.
Weight	45 kg.

Electrical data	
Converter type	IGBT single phase inverter
Cooling system	Water
Output frequency range	0 - 10 kHz*

*: 15/l min each IGBTs heatsink, 8l/min for the capacitor heatsink.

DC/AC Inverter 500V - 690V		Sn [KVA]	In [A]	Pn [kW]	Vin [Vdc]	Vout [Vac]	Fsw [kHz]
110650R1001	SD280V06.HF	280	400	238	930	690	6
110650R1041	SD310V06.HF	310	450	264	930	690	6
110650R1042	SD340V06.HF	340	490	289	930	690	6
110650R1043	SD440V06.HF	440	630	374	930	690	3

SPARTAN

OVERVIEW

SECOM introduced in 2013 a new series of frequency converters designed to supply power to equipment that incorporates technology currently used in induction heating, hardening, smelting and/or other applications where a resonant circuit is required. H bridge configuration is used in SECOM induction heating converters.

The "**Spartan**" is an IGBT power electronic converter developed for high frequency Induction Heating application. The load current and the output frequency of the application define the rated power of the Inverter. The power module is water-cooled.

Strenght point of this solution are:

- IGBT High Frequency technology
- A drastically gas and smoke emission reduction typical of the old heating process
- A reduced energy consumption
- Immediate availability of the heating -> no need long start or stop sequences, as with traditional reheating furnaces.



SPARTAN

DIMENSIONAL DRAWINGS

The power converter of the series SD_LF is constituted by a removable module as shown in the figures below.

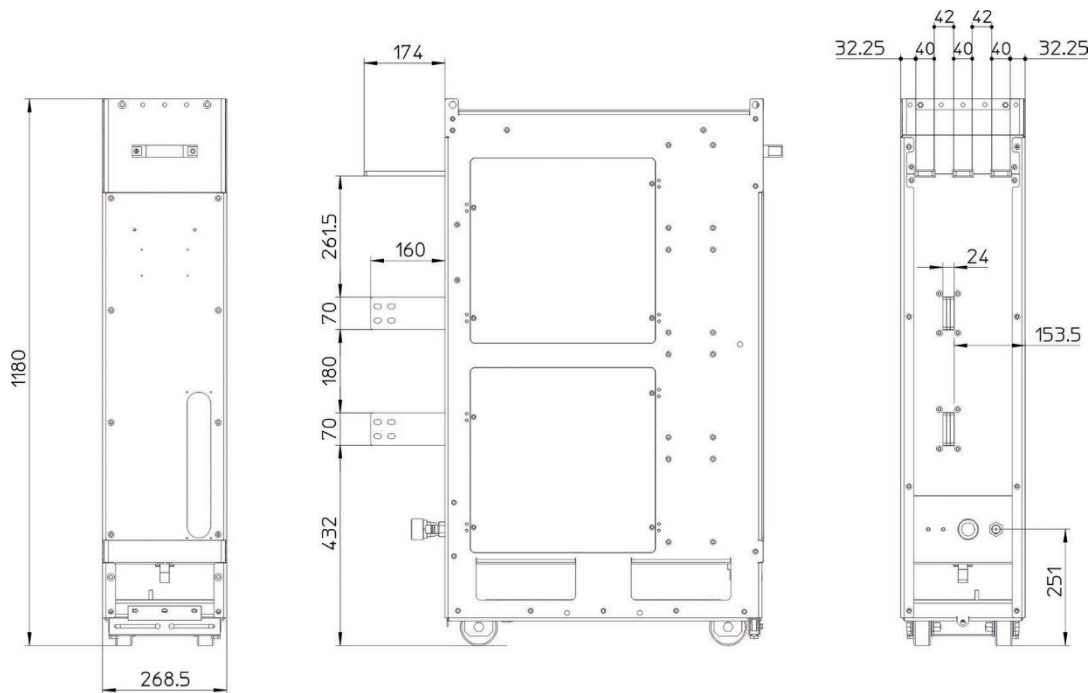


Fig. - Dimensions

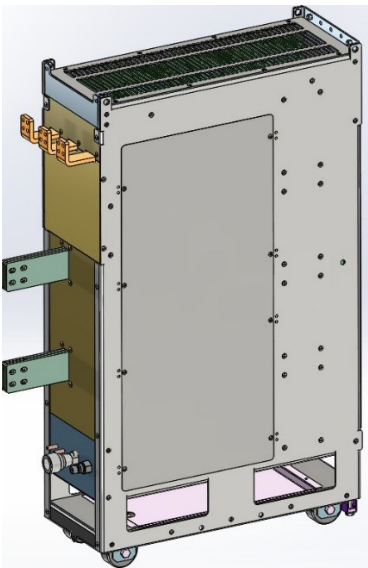


Fig. - Power connection

SPARTAN

COOLING SYSTEM

The power modules are equipped with a cooling system circuit to refresh and cool down the main power devices such as IGBT and input thyristors.

The inlet and outlet of the cooling system are located on the bottom rear side of the module. A system of quick connect couplings guarantee a faster operation maintenance.

The main cooling data have described in tables below.

Data	Value
Internal pipes water Volume (l)	4
Water Flow (l/min) min-max	50-80
Rated Pressure (bar)	2-4
Water Temperature (°C)	10-40*
Max Water Temperature (°C)	40*
Semiconductor losses (kW)	15
Busbar and internal losses (kW)	1,2

* For higher temperature is necessary to consider a derating of the power system

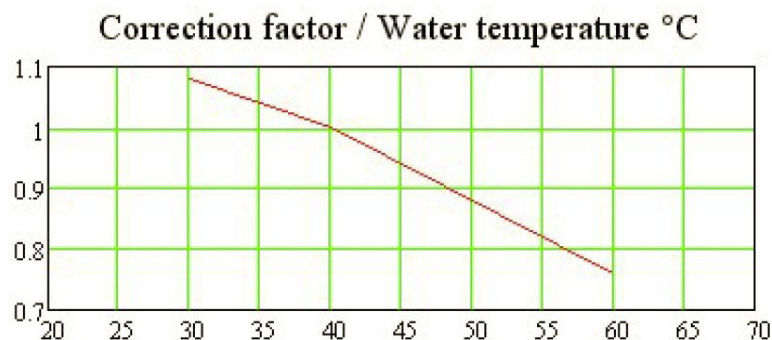


Fig. - Output current vs. water temperature

The power module is equipped with fans to ensure the cooling of the internal parts not water-cooled. The cooling fans have to be supplied by an external power supply 230V_{AC} 50Hz.

SPARTAN

COOLING SYSTEM

In the figure below, output current capability as frequency function has been described. Two limits has to be respected: capacitor limit do to input capacitor ripple and thermal limit. For higher current capability at lower output frequency is necessary a larger capacitor banks.

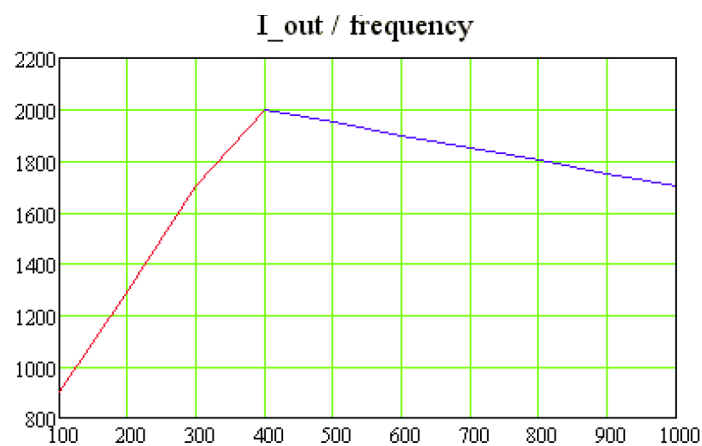


Fig. - Output current vs. output frequency

SPARTAN

TECHNICAL DATA

Ambient conditions	
Altitude	1000 m. a.s.l.
Air temperature	0 ÷ 40°C
Storage temperature	0 ÷ 50°C
Relative humidity	10 ÷ 90 %

Dimensions and weight	
Height	1180 mm.
Width	270 mm.
Depth with long connection	898 (690+208) mm.
Weight	160 kg.

Electrical data	
Inverter rectifier type	Three-phase thyristor bridge $I_N = 1250\text{Adc}$ $I_{MAX} = 1500\text{Adc}$
Fuses (external)	(1250 A aR type suggested)
Output Inverter type	H bridge IGBT inverter
Cooling system	Air/water
Rated current	1700 A
Commutated current	1700 A
Supply voltage	400 ÷ 720Vac
Output voltage (square waveform)	up to +VDCBUS
Output frequency	200 ÷ 1000 Hz

The main technical data of the power converter (type LF_H) are given below:

Description	N. Module	AN kVA	$I_{CONT. MAX}$ A	$P_{CONT. MAX}$ kW	Dimensions (W*D*H) mm
AC/AC Inverter 380-415 @ 1 kHz					
SD220V04.LF	1	220	540	204	898*270*1180 mm.
SD280V04.LF	1	280	670	255	898*270*1180 mm.
SD560V04.LF	1	560	1340	510	898*270*1180 mm.
AC/AC Inverter 440-480 @ 1 kHz					
SD310V05.LF	1	310	640	280	898*270*1180 mm.
SD340V05.LF	1	340	700	306	898*270*1180 mm.
SD650V05.LF	1	650	1350	595	898*270*1180 mm.
AC/AC Inverter 500-690 @ 1 kHz					
SD450V06.LF	1	530	770	383	898*270*1180 mm.
SD600V06.LF	1	600	870	434	898*270*1180 mm.
SD1170V06.LF	1	1170	1700	850	898*270*1180 mm.



TESEO

OVERVIEW

SECOM introduced in 2013 a new series of frequency converters designed to supply power to equipment that incorporates technology currently used in induction heating, hardening, smelting and/or other applications where a resonant circuit is required. H bridge configuration is used in SECOM induction heating converters.

The “**Teseo**” is an IGBT power electronic for induction heating applications. The electrical power flowing through the “H-Bridge” inverter is converted in thermal power by means of an inductor (outside the power module).

The output frequency is defined by the working point of the application.

The control unit is outside the inverter and commands the IGBT and reads the current and other feedbacks in order to control the injected power in the inductor.

Strength points of this solution are:

- IGBT High Frequency technology
- A drastically gas and smoke emission reduction typical of the old heating process
- A reduced energy consumption
- Immediate availability of the heating -> no need long start or stop sequences, as with traditional reheating furnaces.

TESEO

OVERVIEW

The **TESEO** is an DC/AC converter with H-Bridge topology.

The short description of the machine is described below:

The SDXXXXV06.LFT, where the XXXX is the active power (kW) calculated at 50 z output current.

There are 4 inverter sizes, are in the table below:

Model name	Nominal current @ 50 Hz [Arms]	Ac voltage input [Vrms]	Capacitor value [μ F]	Overcurrent value [A _{pk}]	Overvoltage value [V _{pk}]
SD600KV06.LFT	750	690+5%-10%	16800	Nd	1050
SD840KV06.LFT	1050	690+5%-10%	23800	4400	1050
SD1M20V06.LFT	1500	690+5%-10%	33200	4400	1050
SD1M52V06.LFT	1900	690+5%-10%	47600	4400	1050

The control system is interfaced with the power module through the fiber optic and connectors located in the interface board (INTER_TES).

TESEO

MECHANICAL DATA

The machine has three different size, listed in the table below (without bars):

Model name	W (mm)	D (mm)	H (mm)
SD0600KV06.LFT	350	690	1354
SD0840KV06.LFT	350	690	1354
SD1200KV06.LFT	390	690	1354
SD1540KV06.LFT	470	690	1354

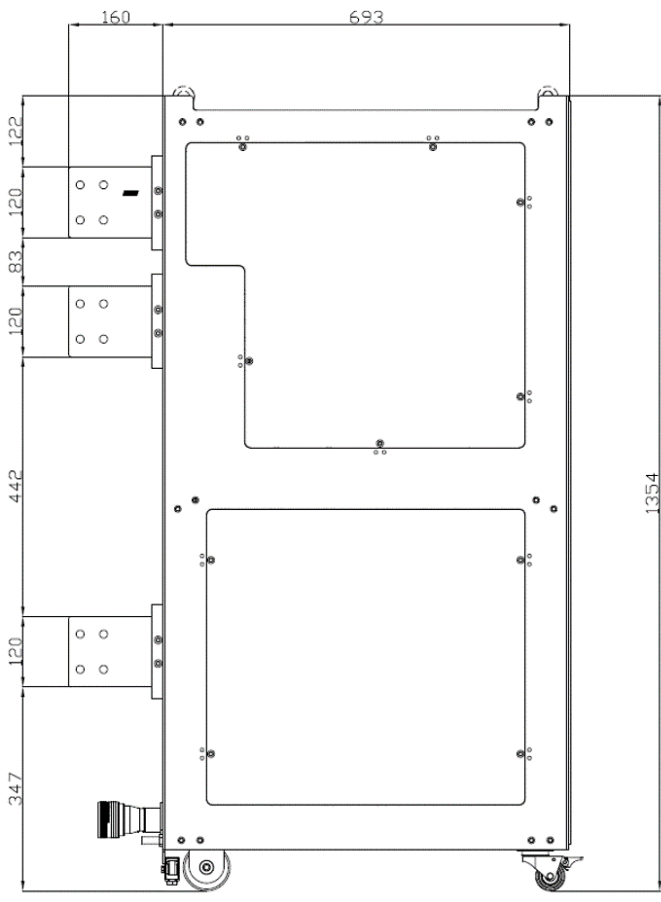


Fig. - SD600V06.LFT and SD840V06.LFT left side view

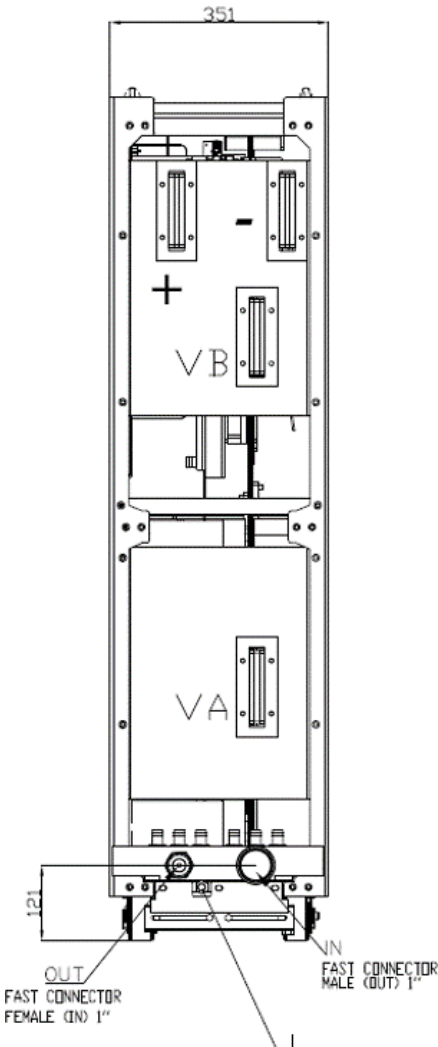


Fig. - SD600V06.LFT and SD840V06.LFT rear side view

TESEO

MECHANICAL DATA

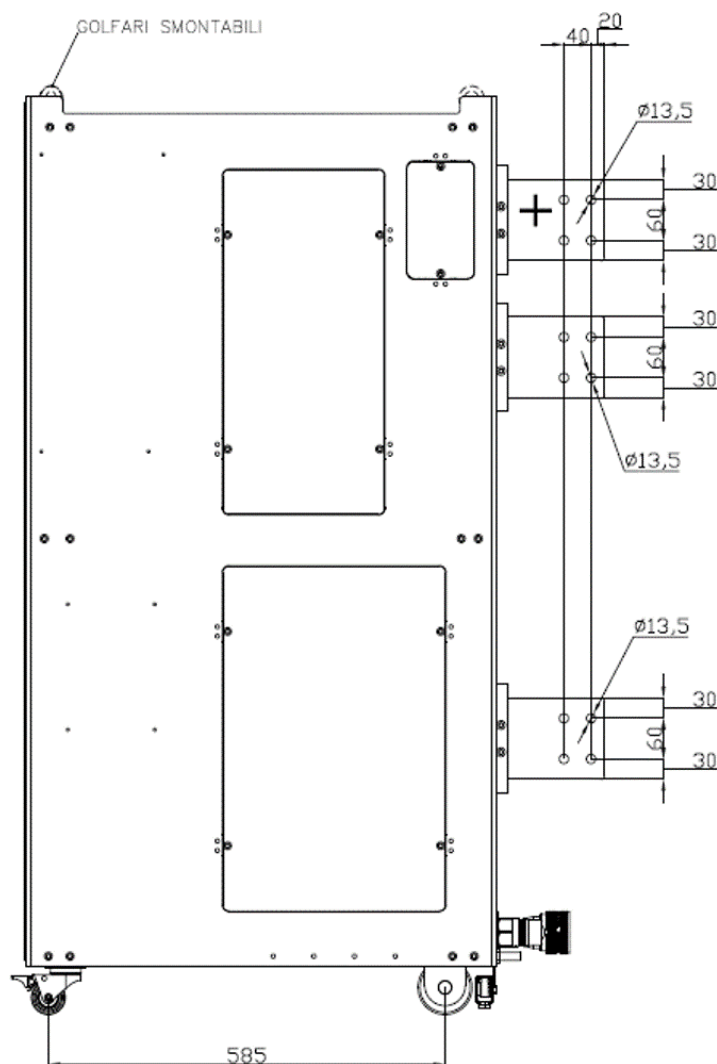


Fig. - SD600V06.LFT and SD840V06.LFT right side view

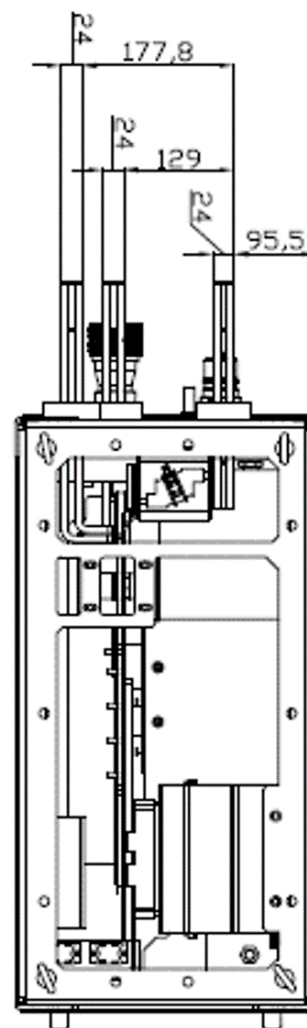


Fig. - SD600V06.LFT and SD840V06.LFT top side view

TESEO

COOLING SYSTEM

The power modules are equipped with a cooling system circuit to refresh and cool down the IGBT. The inlet and outlet of the cooling system are located on the bottom rear side of the module. A system with quick connector guarantees a fast operating maintenance. It is mandatory to respect the water flow value described.

Data	Value
Internal pipes water volume [L]	4
Water flow [L/min]	> 40
Rated pressure drop [bar] @ 40 L/min	1.7
Operating temperature range [°C]	10÷40
Maximum absolute pressure [bar]	3
Semiconductor losses [kW]	18
Heatsink material	Aluminium
Water type	Distilled
Water maximum conductivity [μ S/cm]	< 50
Water pH	7÷8
Water hardness	3÷10 °dH
Undissolved particles	< 5 mg/l
Quick connection type	76KB (1")

It is mandatory to use only stainless steel or aluminum in the entire hydraulic circuit connected to power module.
The water flow/pressure drop characteristic is showed in the table below.

Water flow [l/min]	ΔP [Bar]
20	0.7
30	1.15
40	1.7
50	2.8

TESEO

TECHNICAL DATA

Ambient conditions	
Altitude	1000 m. a.s.l.
Air temperature	0 ÷ 40°C
Storage temperature	0 ÷ 50°C
Relative humidity	10 ÷ 90 %
Maximum pollution degree	2

Dimensions and weight	
Height	1500 mm.
Width	350 ÷ 540
Depth with short connection	690 mm
Depth with long connection	820 mm

Electrical data	
Converter type	
Cooling system	Water
Supply voltage	530 ÷ 930 V _{DC}
Output frequency	50 ÷ 1000 Hz

Freq. Out [Hz]	I _{rms} [A]	I _{cMax} [A _{peak}]	V _{dc} max[V]	Power out [kW]	V _{ac} in [V]	V _{dc} range [V]
50	750	958	1000	608	380÷690	530÷1000
100	1250	1133	1000	1013	380÷690	530÷1000
200	1850	2466	1000	1499	380÷690	530÷1000
300	2350	3133	1000	1904	380÷690	530÷1000
400	2650	3533	1000	2147	380÷690	530÷1000
500	2850	3800	1000	2309	380÷690	530÷1000
1000	2800	3733	1000	2269	380÷690	530÷1000
1500	2500	1850	1000	2026	380÷690	530÷1000
2000	2300	1600	1000	1864	380÷690	530÷1000
2500	2150	1300	1000	1742	380÷690	530÷1000
3000	1900	1000	1000	1540	380÷690	530÷1000

Fig. - Derating table for SD0600KV06.LFT

TESEO

TECHNICAL DATA

Freq. Out [Hz]	I _{rms} [A]	I _{cMax} [A _{peak}]	V _{dc} max[V]	Power out [kW]	V _{ac} in [V]	V _{dc} range [V]
50	750	958	1000	608	380÷690	530÷1000
100	1250	1133	1000	1013	380÷690	530÷1000
200	1850	2466	1000	1499	380÷690	530÷1000
300	2350	3133	1000	1904	380÷690	530÷1000
400	2650	3533	1000	2147	380÷690	530÷1000
500	2850	3800	1000	2309	380÷690	530÷1000
1000	2800	3733	1000	2269	380÷690	530÷1000
1500	2500	1850	1000	2026	380÷690	530÷1000
2000	2300	1600	1000	1864	380÷690	530÷1000
2500	2150	1300	1000	1742	380÷690	530÷1000
3000	1900	1000	1000	1540	380÷690	530÷1000

Fig. - Derating table for SD0600KV06.LFT

Freq. Out [Hz]	I _{rms} [A]	I _{cMax} [A _{peak}]	V _{dc} max[V]	Power out [kW]	V _{ac} in [V]	V _{dc} range [V]
50	1050	1134	1000	851	380÷690	530÷1000
100	1700	2252	1000	1377	380÷690	530÷1000
200	2350	2538	1000	1904	380÷690	530÷1000
300	2650	2862	1000	2147	380÷690	530÷1000
400	3000	3240	1000	2431	380÷690	530÷1000
500	2900	3866	1000	2350	380÷690	530÷1000
1000	2800	2792	1000	2269	380÷690	530÷1000
1500	2500	1816	1000	2026	380÷690	530÷1000
2000	2300	1572	1000	1864	380÷690	530÷1000
2500	2150	1281	1000	1742	380÷690	530÷1000
3000	1900	960	1000	1540	380÷690	530÷1000

Fig. - Derating table for SD0840KV06.LFT

TESEO

TECHNICAL DATA

Freq. Out [Hz]	I _{rms} [A]	I _{cMax} [A _{peak}]	V _{dc} max[V]	Power out [kW]	V _{ac} in [V]	V _{dc} range [V]
50	1500	1620	1000	1215	380÷690	530÷1000
100	2200	2376	1000	1783	380÷690	530÷1000
200	2900	3132	1000	2350	380÷690	530÷1000
300	3000	4000	1000	2431	380÷690	530÷1000
400	3000	3240	1000	2431	380÷690	530÷1000
500	2900	3866	1000	2350	380÷690	530÷1000
1000	2800	2792	1000	2269	380÷690	530÷1000
1500	2500	1816	1000	2026	380÷690	530÷1000
2000	2300	1572	1000	1864	380÷690	530÷1000
2500	2150	1281	1000	1742	380÷690	530÷1000
3000	1900	960	1000	1540	380÷690	530÷1000

Fig. - Derating table for SD1200KV06.LFT

Freq. Out [Hz]	I _{rms} [A]	I _{cMax} [A _{peak}]	V _{dc} max[V]	Power out [kW]	V _{ac} in [V]	V _{dc} range [V]
50	1900	2052	1000	1540	380÷690	530÷1000
100	2400	2592	1000	1945	380÷690	530÷1000
200	3000	3240	1000	2431	380÷690	530÷1000
300	3100	3348	1000	2512	380÷690	530÷1000
400	3100	3348	1000	2512	380÷690	530÷1000
500	2900	3132	1000	2350	380÷690	530÷1000
1000	2800	2792	1000	2269	380÷690	530÷1000
1500	2500	1850	1000	2026	380÷690	530÷1000
2000	2300	1600	1000	1864	380÷690	530÷1000
2500	2150	1300	1000	1742	380÷690	530÷1000
3000	1900	1000	1000	1540	380÷690	530÷1000

Fig. - Derating table for SD1540KV06.LFT

